Title: Stem and Leaf Plot and Line Plot Analysis
Let the Games Begin: Olympic Trials in Data Analysis

Brief Overview:

The students will conduct three days of Olympic Games. They will display the data in either line plots or stem and leaf plots. On the final day the students will write newspaper articles interpreting the results of the games. The winning team will receive a gold medal at a closing ceremony.

NCTM Content Standard

Number and Operations

- understand numbers, ways of representing numbers, relationships among numbers, and number systems;

Measurement

- understand measurable attributes of objects and the units, systems, and processes of measurement;
- apply appropriate techniques, tools, and formulas to determine measurements.

Data Analysis and Probability

- formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them;
- select and use appropriate statistical methods to analyze data

Grade/Level:

Grade 5

Duration/Length:

This unit will be taught in four 50 minute sessions.

Student Outcomes:

Students will:

- Collect, organize, and display data in a stem and leaf plot.
- Collect, organize, and display data in a line plot.
- Interpret and compare the results of a stem and leaf plot.

- Interpret and compare the results of a line plot.

Materials and Resources:
Scissors
Markers
Milk cartons
1 ½ inch toy wheels
construction paper
Glue
Straws
String
Balloons
Measuring Tape
Calculator (optional)
Stopwatch

Development/Procedures:

Lesson 1 Chariot Races Plotted on a Back to Back Stem and Leaf Plot

Preassessment –This lesson may be taught in conjunction with the study of ancient Greece. Greet the class dressed in a white sheet as a toga and a crown of grape leaves on your head. Begin by asking the students how they would choose to display data for interpretation. Once the students explain the idea of graphs and plots, ask the students to name a few examples of various graphs and plots that they have used in the past. Ask the students if they can describe a line plot and a stem and leaf plot. Extend that by asking if they know what a back to back line plot or back to back stem and leaf plot would look like.

Launch – Ask: "*What would you consider to be one of the most popular contributions to modern society from Greece?*" Once the idea of the Olympics is stated by one of the students, launch into an explanation of the next four days. Say:

- *We will be studying how to collect, display, and analyze data using the theme of the Greek Olympics. At the end of these four days you will have collected data from your teams' efforts in the Olympic events that we will be holding here in the classroom. We will have chariot races, javelin air balloon races, and a race to complete a puzzle. All of your scores will be plotted, displayed, and interpreted. At the end of the events, you will be asked to write a newspaper article for a sports page describing the results of our Olympic Games. The winning team will receive the Gold Medal.*

- *The first ancient Olympics were held in Olympia Greece in 776 B.C. Olympia was one of the oldest religious centers in Greece. These original games were more like a religious festival and included competitions in gymnastics, music, reading, and writing. In this way the competitors were trying to achieve a balance of body, mind, and spirit.*

- *Does anyone know where the 2004 summer Olympics will be held? They will be in Athens, Greece, which was the location of the first modern Olympics in 1896.*

Separate the students into teams of 3-4 each. Have them name their teams after a country.

Teacher Facilitation – Distribute a milk carton, 4 wheels, 4 wheel caps, and two axels to the students. Model the building of a chariot with the milk carton. Make four holes in the bottom of the carton in each corner. The wheels and axels are placed in these holes. The students can then decorate the chariots with clip art from the computer or with colored paper (Teacher Resource Sheet #1). Each student will make an individual chariot.

Tape a tape measure or yard stick to the floor to measure the distances of the chariots. Each student will have two turns. Each student will place his/her chariot at the start line and flick the chariot with the index finger and thumb flicking the cart. Each student will measure his/her distance.

Give each student two laminated squares of a chariot and driver (Teacher Resource Sheet #1). These will be labeled with the students' names and the results of their races in distance (cm). Make a white Greek Column for the "stem" to hang on the wall. Tape squares to the wall as the "leaves". One side will have the results of the first trial and the other side will have the results of the second trial for a back to back stem and leaf plot.

Student Application – Students will complete the two student resource sheets, Student Resource 1A and 1B. Then ask the students to determine the range, clusters, gaps, distribution, median, mode, and mean (for extra credit). Students will make a stem and leaf plot where they will be expected to have a key and title as well as the data.

Embedded Assessment – Ask the students to compare their results with the other students on their team. Observe those students who seem to have missed the main ideas.

Reteaching/Extension –

- For those who have not completely understood the lesson, go back and rework the Student Resource 1A & B.
- For those who have understood this lesson, allow them to compute the mean of the scores. They may use a calculator. They can use the Student Resource 1C to collect data.
- As a group, work out the mean of each team's scores to determine the day's winner. These scores will be tabulated for the total at the end of the four days.(Student Resource 1C)

Lesson 2 Javelin Air Balloon Contest

Materials – string, straws, balloons, tape, scissors, chairs, pencils, Mean sheet, construction paper, markers

Preassessment – Students should be familiar with number line plots for this lesson. You may want to give a brief review.

Launch – Ask students to brainstorm ways they could conduct a contest similar to the Javelin where an object has to travel for some measure of length. The teacher will record students' responses on the board.

Teacher Facilitation –Explain to students that they are going to perform a simulation of the Javelin Throw using balloons. Have students break into their teams. Have students make a track for their team. (It's best to clear the room of the desk.) You may use 2 chairs approximately 7-8 feet apart. (You may need to adjust this depending on how far the balloons can travel.) Have students tape one end of the string to the back of one chair. Place the string through one straw. Tape the other piece of string to the second chair. This is your track. You may have as many tracks as you have groups. Make the start of the track the place where the straw meets the back of the chair. Give construction paper to each group. Have students write their country and their names and tape it to the chalkboard.

Student Application – Students are given balloons as their javelins. Students blow up their balloons as they approach the track for their race. Have another student place a piece of tape to the balloon so the contestant may tape their balloon to the straw. Make sure the balloon opening is facing the back of the chair so that it propels forward. The teacher may act as the starter so all students start at the same time. Students will measure the distance the balloon traveled in centimeters. The teacher will record results on the construction paper taped to the board as students record the results of their team on their papers. Students will calculate the mean for their team.

Embedded Assessment –Check team means. Students should be able to calculate the mean of team members' scores.

Reteaching/Extension

- For those who have not completely understood the lesson, go back and rework the Student Resource 2A, B, and C.
- For those who have understood this lesson, allow them to compute the mean of the scores. They may use a calculator. They can use the Student Resource 2D to collect data.
- As a group, work out the mean of each team's scores to determine the day's winner. These scores will be tabulated for the total at the end of the four days.(Student Resource 2D)

Lesson 3

Preassessment - Ask the students which plot they think would best display individual times used to complete a task. They can choose between a stem and leaf plot or a line plot. Ask if they have any preferences. Remind them that they are in their final day of games for the Olympics and that the next day is for the wrap up and closing ceremonies.

Launch – As a warm up exercise, have the students complete a random sample of the Olympian population as seen on Student Resource 3A. Read the top of the worksheet to the students so that they are thinking in terms of the numbers of people who will be participating in the 2004 Summer Olympics in Greece. The students will cut out 1" squares and follow the directions on Students Resource 3A to determine the sample population on Student Resource 3C. Teacher Resource 3B contains a one inch square chart which can be copied on an overhead and used to demonstrate. This can be worked on as a class altogether. Students will then complete Student Resource 3B as a writing sample to demonstrate their mastery of taking a sample population.

Teacher Facilitation – Introduce this next exercise as the final event in your Olympic games. Students will return to their teams. Each student will have two opportunities to put together a puzzle of a Grecian urn (Teacher Resource 3C). They will not know what the puzzle will look like when finished and they will work behind a privacy screen so that the other team members do not have an unfair advantage of knowing what the final product looks like. Another member of the team will time the effort. They should make two attempts to see if there is a difference between not knowing the outcome and knowing the outcome.

Student Application – A back to back line plot will be made of the first attempt on the top and the second attempt on the bottom. Different color Xs can be used to differentiate teams. Once each student has had the opportunity to go twice, the students will determine the mean time for their team.

Embedded Assessment – Have the students included a key, and title in their line plots? Ask students to complete Student Resource 3E and 3D. Check for accuracy.

Reteaching/Extension –

- For those who have not completely understood the lesson, go back and rework the Student Resource 3D, E, and F.
- For those who have understood this lesson, allow them to compute the mean of the scores. They may use a calculator. They can use the Student Resource 3F to collect data.

- As a group, work out the mean of each team's scores to determine the day's winner. These scores will be tabulated for the total at the end of the four days. (Student Resource 1F)

- For those students who would like an extra challenge, you can begin to explain a box plot to them and ask them to try to construct one with their data from the line plot.

Lesson 4

Summative Assessment:

This day is the completion of the lesson plan. It will be a celebration. Create a festive atmosphere for the closing ceremonies. You may use music and medals for awards. Students may dress in white sheets as togas if you focus on ancient Olympics or athletic wear if you are concentrating on the modern Olympics. Students may walk around the classroom and view all of the plots posted in the classroom.

Provide the students with all of the data from the three events. With this data the students will each write a newspaper article describing the events. For each mathematical term they use they will receive extra points for their team. Walk around the classroom awarding gold rings around the words which earn extra points. The students may use Student Resource 4A to write their articles and Student Resource 4C as a rubric for the assignment.

Total team scores may be calculated on Student Resource 4B.

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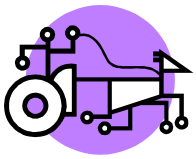
Stem & Leaf Plot of Chariot Race

Title:

Key



Chariot Race Results

What is the shortest distance? _____

What is the longest distance? _____

Describe the range. _____

Is there a cluster? Where? _____

Is there a gap? Where? _____

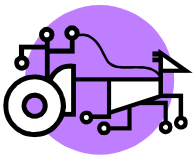
Is the distribution symmetrical? _____

Is there an outlier? Which one? _____

What is the median? _____

What is the mode? _____

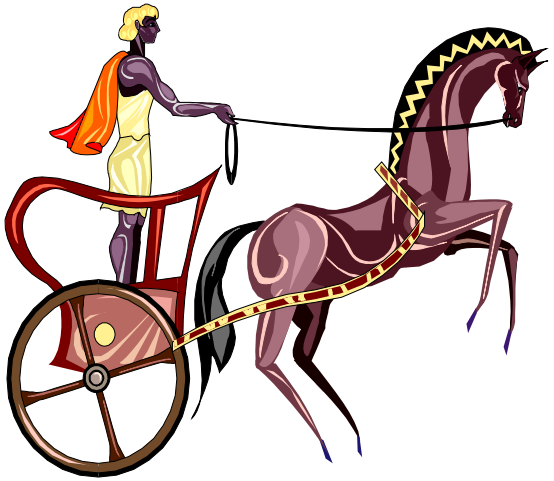
What is the mean? _____



Find the Mean for Your Team!

Team members	Distance Traveled

Team members	Distance Traveled



Javelin Air Balloon

2004 Athens
Javelin Air Balloon Contest
Stem and Leaf Plot

Javelin Air Balloon Race Results

What is the shortest distance? _____

What is the longest distance? _____

Describe the range. _____

Is there a cluster? Where? _____

Is there a gap? Where? _____

Is the distribution symmetrical? _____

Is there an outlier? Which one? _____

What is the median? _____

What is the mode? _____

What is the mean? _____

Find the Mean for Your Team!

Team members	Distance traveled

Team members	Distance traveled

Athens 2004
Census of Olympians

The Olympics will be returning to Athens August 13-29, 2004.
This is the site of the first modern Olympics held in 1896.

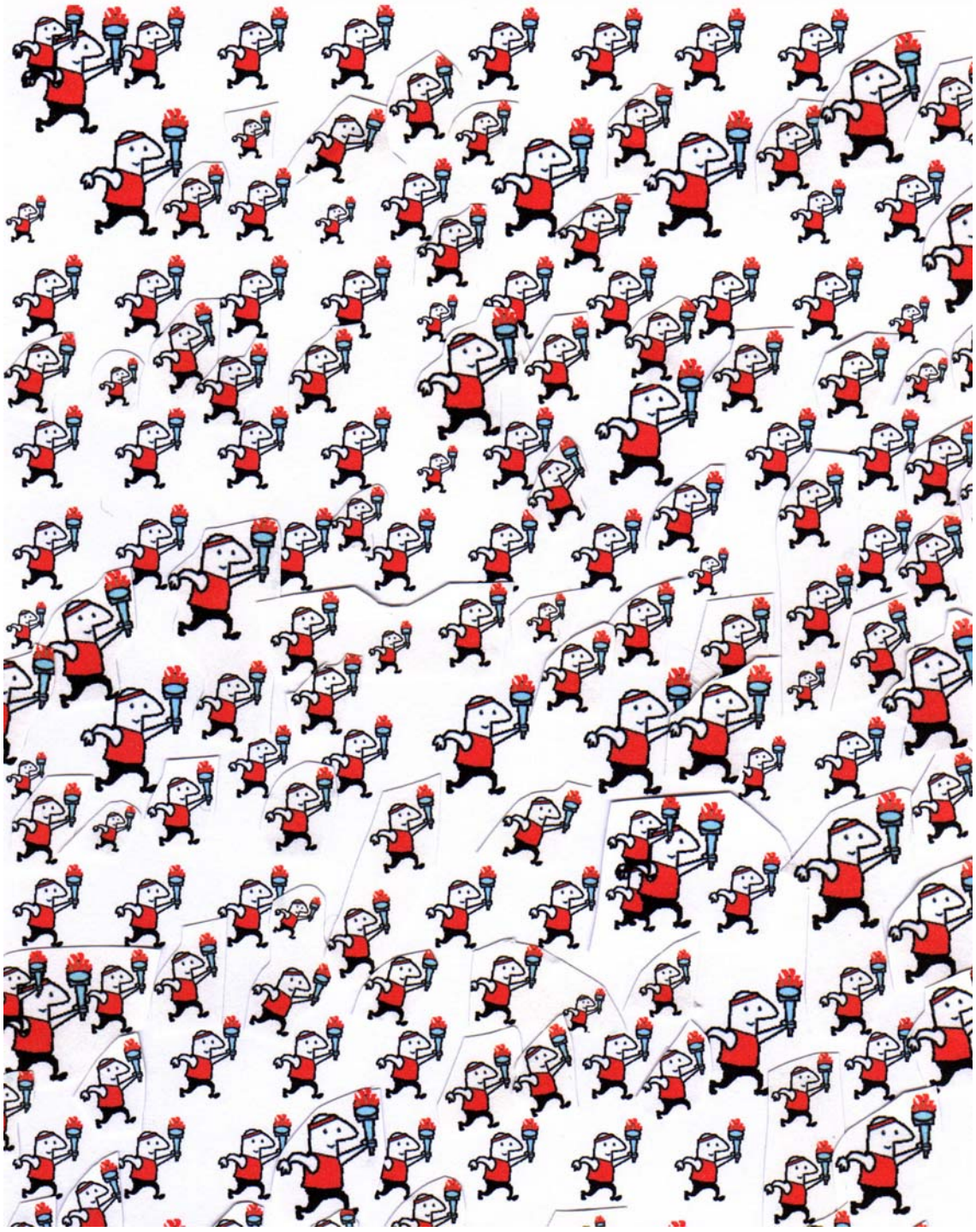
It is estimated that over these 16 days there will be:
301 Medal Ceremonies
28 Sports in 38 Venues
10,500 Athletes
3,000 Team Officials
16,000 Athletes and Officials
at the Olympic Village

Random Sample Data

Predict how many Olympians are in this village.	A._____
Record 5 random samples	1._____
	2._____
	3._____
	4._____
	5._____
Add the five samples together for a sample total.	**B.**_____
Divide the sum by 5 for the sample average.	**C.**_____
Multiply by the number of square units.	**D.**_____
Record the population estimate.	**E.**_____
Record the actual population.	**F.**_____
Calculate the difference (E.-F.).	**G.**_____

Athens 2004
Census of Olympians

Reflection: Write 3-5 sentences explaining your findings.



Tangram Completion

Tangram Completion Results

What is the shortest time? _____

What is the longest time? _____

Describe the range. _____

Is there a cluster? Where? _____

Is there a gap? Where? _____

Is the distribution symmetrical? _____

Is there an outlier? Which one? _____

What is the median? _____

What is the mode? _____

What is the mean? _____

Find the Mean for Your Team!

Team members	Time

Team members	Time

Athens 2004
Census of Olympians

The Olympics will be returning to Athens August 13-29, 2004.
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at the Olympic Village

Cut out 1" Square for sample

Random Sample Data

(example)

Predict how many Olympians are in this village.	A. 206
Record 5 random samples	1. 3
	2. 4
	3. 3
	4. 3
	5. 4
Add the five samples together for a sample total.	**B.** 17
Divide the sum by 5 for the sample average.	**C.** 3.4
Multiply by the number of square units.	**D.** 63x3=189
Record the population estimate.	**E.** 189
Record the actual population.	**F.** 155
Calculate the difference (E.-F.).	**G.** 34

Analyzing the Class Data

Write a newspaper article reporting the results of the contest. Utilize the data generated by the class to tell the audience what happened. Give your article a title.

Find the Mean for Your Team!

Team members	Day 1	Day 2	Day 3

Team members	Day 1	Day 2	Day 3

Newspaper Article Rubric

Criteria	Score
• No spelling or grammatical errors. • Contains a strong introduction with a topic sentence. • Uses math vocabulary words 4 or more times correctly throughout the article. (Uses results from the events.) • Completely and clearly describes the events of the Olympics. • Contains a strong conclusion.	4
• Contains 2-3 spelling and grammatical errors. • Contains a weak introduction with a topic sentence. • Uses math vocabulary words at least 3 times correctly throughout the article. (Uses results from the events.) • Describes the events of the Olympics. • Contains a strong conclusion.	3
• Contains 4-5 spelling and grammatical errors. • Contains an introduction without a topic sentence. • Uses math vocabulary words at least 4 times correctly throughout the article. • Describes one event of the Olympics. • Contains a strong conclusion.	2
• Contains more than 5 spelling and grammatical errors. • Contains no introduction or conclusion. • Uses no math vocabulary words. • Does not describe the events of the Olympics.	1
• No Performance.	0